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Developing On-line Collaborative Research Across International Boundaries: Exploring the Potential of New Technologies

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Abstract
The development of on-line research practice across international boundaries is now a viable proposition using available asynchronous technologies such as computer conferencing. As has been reported in previous papers (Grodzinsky, et al, 2002; Griffin, et al, 2002) such use has proved to be extremely valuable for supporting the teaching of computing and ethics. However, asynchronous computer conferencing not only offers new opportunities for teaching and for supporting students, it also offers a valuable resource to researchers. Taking advantage of such opportunity must, of course, address a number of issues. Prime amongst these are concerns as to how to overcome the variety of barriers that are likely to be encountered in establishing effective research collaboration within a text-based virtual environment. This paper will, therefore, outline how such research collaboration was initiated across international boundaries as well as providing an overview of the activity undertaken. The primary goal of this paper is, therefore, to illustrate both the challenges and benefits of undertaking on-line research collaboration.

Keywords
Scholarship of Teaching and Learning, SoTL, On-line collaborative research, Asynchronous computer conferencing, International research collaboration

Developing On-line Collaborative Research Across International Boundaries: Exploring the Potential of New Technologies

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Abstract

The development of on-line research practice across international boundaries is now a viable proposition using available asynchronous technologies such as computer conferencing. As has been reported in previous papers (Grodzinsky, et al, 2002; Griffin, et al, 2002) such use has proved to be extremely valuable for supporting the teaching of computing and ethics. However, asynchronous computer conferencing not only offers new opportunities for teaching and for supporting students, it also offers a valuable resource to researchers. Taking advantage of such opportunity must, of course, address a number of issues. Prime amongst these are concerns as to how to overcome the variety of barriers that are likely to be encountered in establishing effective research collaboration within a text-based virtual environment. This paper will, therefore, outline how such research collaboration was initiated across international boundaries as well as providing an overview of the activity undertaken. The primary goal of this paper is, therefore, to illustrate both the challenges and benefits of undertaking on-line research collaboration.

Introduction

This paper describes a piece of international research that was initiated as a consequence of an email, calling for project collaboration, sent by one person to a mail base distribution list. Through the various email communications that followed, it was quickly discovered that there were three of us, each in different countries, who were not only teaching modules of a very similar nature but also had very similar research aspirations. For example, Professional Issues in Software Engineering (PISE) (University of Limerick) was a final year undergraduate module for computer science students that focused on the legal, ethical and social aspects of computing. Although the module had been taught for a number of years at the university, increased student numbers had added to the pressure to re-evaluate the existing group teaching and assessment methods. A module, very similar in content, was taught at De Montfort University (UK). This was entitled The Professional Context of ICT (PCICT) and for the past three years, had been offered to final year undergraduate Software Engineers as a compulsory module. However, the module, this particular year, was to be offered across two geographically dispersed campuses of the university as an option for all final year computing undergraduates. Finally, the course offered at Sacred Heart University (USA), entitled Computer Ethics: Society and Technology (CEST) had been developed by a professor in computer

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science and was a required senior level course for all computer science and information technology majors. Each of the members of staff involved in teaching these modules within the different universities were also research active and were keen to work collaboratively in order to address some of the issues that they were each facing in trying to integrate the "authentic" use of technology within the teaching of computer ethics.

Independently, all three instructors had, as it happened, been using discussion boards within some form of Virtual Learning Environment (VLE), (Blackboard or WebCT), for supporting collaborative learning in their modules. Justification for using a collaborative, discursive approach was, of course, underpinned by the fact that researchers have already identified the positive effects of social interaction during learning [Crook, 1999; Dillenbourg, 1999]. Furthermore, collaboration with other students has been shown to stimulate activity, make learning more realistic and to stimulate motivation. [Veerman, and Veldhuis-Diermanse, 2001] It has also been suggested that not only is dialogue "an important aspect of a rich learning experience", particularly in complex, discursive domains [Ohlsson, 1995] but that "learning can occur not only through participation in dialogue but also through observing others participating in it" [Stenning, et al, 1999].

Research has also shown that moral dilemmas in computer ethics encourage group discussion, that teamwork encourages social facilitation, better learning and higher cognitive skills [Hiltz, 1994; Saloman and Globerson, 1989] and that groups can produce better solutions to moral and ethical problems than individuals [Peek, et al, 1994]. Because moral judgments are a social construct, it could also be argued that the development of a personal ethical code is best achieved in a group situation. There also seems to be evidence that a collaborative approach to learning supported by instructional technology could potentially lead to deeper understanding and new knowledge creation [Mäkitalo, et al, 2001].

An analysis of learners' learning is, however, increasingly important as instructors try to understand how best to engage their students. The instructors' intent in undertaking this research was, therefore, to demonstrate that tools such as discussion boards facilitate collaborative learning and to that end, may enhance students' moral reasoning skills helping them to become better communicators and critical thinkers [See Griffin, et al, 2002].

Setting Up the Research

After the initial email communication each of the instructors had to decide how he/she would be able to integrate the idea of virtual work groups and subsequent assessment within his/her module delivery. After much deliberation each instructor decided to devote one assignment of the module to an online group collaborative project involving students from each of the three institutions. A decision was taken, at this point, to use a discussion board within the Blackboard VLE that was hosted on the server at the University of Limerick (Ireland) in order that instructors could brainstorm the details of this collaboration. Permissions had, of course, to be sought to facilitate access to the VLE for staff outside of the university but once this had been obtained accounts were set up. Using the discussion board not only facilitated but also greatly enhanced the collaborative activity at this stage because it overcame

the issue of time differences as well as the dissemination by instructors of ideas and documents.

During this time a number of other issues had to be agreed upon with regard to the actual research project itself and how this would impact the students concerned. Thus agreement had to be reached in terms of the learning objectives for the assignment that was to be set, the tasks that were to be set and the assessment criteria. The instructors also had to decide how to structure the use of Blackboard; what content to provide within Blackboard; how to integrate use of the Blackboard system and discussion boards into the face-to-face (F2F) context; and how to monitor student progress. Further discussion then took place regarding the timeline for the project as the differing structures of the academic year had to be taken into consideration. Difficulties encountered here were largely pragmatic due to the different timings for vacations. All of these issues did, of course, rely heavily on the flexibility and willingness of the instructors involved to share their resources with each other.

Agreement was quickly reached regarding these initial issues and students from each of the institutions enrolled themselves onto the Blackboard server hosted by the University of Limerick. Blackboard itself is an integrated set of web-based tools designed for the creation and management of a learning environment. These tools include: course development and management tool, statistical tools, content management tools, communication and collaboration tools, assessment tools, personal information management tools, academic web resources, and system management tools. Using these tools the following facilities are available: publication of learning materials (including links to module-related websites), publication of announcements, provision of a range of collaborative tools including discussion boards and chat rooms, communication tools including email. All files are stored on the Blackboard server (unless a server set of applications has been purchased by an institution). By using this 'shell' approach an instructor can build up a course site for any module with different types of learning materials and can use a range of communication tools to assist with the management and assessment of the module. Students can share files and use communication tools to contact other students and the instructor either synchronously or asynchronously.

In order to facilitate this piece of research each of the instructors developed a color-coded file area within Blackboard into which they uploaded institution specific resources. These were, however, available to all students irrespective of where they were studying which meant that the availability of resources was immediately tripled for the students. In addition to these 'institution specific' resources there were general resource areas where students from all institutions could access materials that were common to all of them. These included the assignment specification itself, the assessment criteria and resources designed to help them develop their approach to ethical analysis. Students were also given access to group discussion areas that were only available to the identified group members as well as general discussion boards that were available to all of them.

Constructing Virtual Work Groups

While collaborative learning has been shown by research to have positive effects, [Lehtinen, E., et al, 1999] it has also been noted that the use of group-based approaches can sometimes present a major problem when it comes to assessment. This is primarily due to the possibility of some individuals gaining more (in terms of grades) than they have put into the process, a term that has been called 'free-riding' [Shepperd, 1993]. There is also the potential for the group to be dominated by the stronger students, leaving the weaker students behind. Although research has suggested that larger groups can increase the advantages to members [Veerman and Veldhuis-Diermanse, 2001], these can also increase the occurrence of free-riding due to the difficulty of monitoring these larger groups. Thus it was decided, for the first fieldwork study, that groups with a maximum of 6 members would be prescribed. These would be made up of 2 students from each of the 3 countries involved. In Ireland and England, students chose their partner in the group. These students all knew each other fairly well having been together over several years. In the USA, there were random pairings assigned because the students did not really know each other. The first year of the project then started with 7 fairly balanced groups. However, due to illness in one case, a loss of students at one De Montfort site, and an uneven number in another, one group was smaller (4 participants) and another was overwhelmingly Irish. Overall, these groups were moderately successful in terms of their collaborative activity and assessment outcome. However, it was due to these findings that instructors decided to seek other methodologies by which they could refine the way students were grouped for subsequent collaborations.

The second year that we ran the collaboration, therefore, the Belbin (1981) Self-perception Inventory Test was used to assess the strengths and weaknesses of students vis a vis roles within a group setting. Belbin's (1981) research indicated that identification of these team roles, based on Intelligence, Dominance, Extroversion/Introversion and Stability/Anxiety factors, could then be used to construct balanced teams. Students were, therefore, asked to complete the Self-Perception Inventory and were then classified according to one of 8 roles identified by Belbin (1981) – Chairperson, Shaper, Monitor/Evaluator, Team Worker/Builder, Company Worker/Implementer, Resource Investigator, Completer/Finisher or Plant. These classifications were then used to group the students together for the purposes of the assignment. Because of the difficulties of getting exactly the right number of different "group types" plus the fact that there were 8 roles identified and there were to be only 6 students in each of the groups some adjustments obviously had to be made to try to maintain the necessary balance. This was achieved because Belbin's (1981) framework identifies 4 "inward looking" and 4 "outward looking" roles so in setting up the groups we included 3 of each type (inward/outward looking). The underpinning rationale for using this particular instrument was to try to establish effective teams by bringing together people with individual differences who had the variety of requisite skills needed for group work to see if this improved overall performance. [For further analysis of this methodology see Jefferies, et al, 2004].

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International Collaboration

For both fieldwork studies, students in one of the institutions (Ireland) were asked to volunteer to be part of the international collaboration as student numbers in this institution were much larger than in either of the other two institutions which meant that not all of the Irish students could be incorporated into the international groups. Thus the students in Ireland used the VLE either as members of the international groups or as members of the single-campus-based groups. However, the assignment for all students, working in international or single-campus based groups, was identical. This was a scenario-based project, where each group would choose a case study on a computer related ethical dilemma, conduct an analysis and present a collaborative paper based on its research and threaded discussions. Under course documents, instructors posted the project guidelines, scenarios and applicable documents about ethical analysis and ethical theories. Students were encouraged to email any of the instructors with problems. Each instructor agreed to visit the group pages weekly to monitor activity so that he/she could offer support to students within each of the groups and give direction where needed in the F2F sessions. As noted earlier, creating a timetable was one of the more difficult administrative tasks because each course started at a different time and vacations in the three countries were never at the same time. Based on this constraint, the project began in March and the completed assignment (report) was due to be submitted on April 24th. For the first year, it was decided that each instructor would weigh the project according to its place in the syllabus. At UL (Ireland), it counted as 50% of the course grade, in DMU (UK), 20% and in the Sacred Heart (USA) 10%. This was due, in part to having to fit the collaboration into an already existing syllabus. The second year it was run, the project counted for 30% of the module assessment across the board. After the first year's experience, it had been decided that in order to have an equal amount of student commitment to the project, the weighting given to the assignment within each course had to be the same. A common rubric was also used for assessment across the three sites.

Collaboration Analysis

At the end of the first year of the project the instructors undertook transaction analysis (Freeman (1978/9) as well as conversation analysis in order to determine student activity. In the International Collaboration, a student cohort of 41 and three instructors used the Blackboard CLMT over a 9-week period. Statistics were gathered using the Course Statistics tool available within Blackboard. There were approximately 23,364 hits in total over the entire period. These can be categorized as follows:

- Accessing the group pages
- Collaborating using self-regulated discussion groups
- Using the file exchange to share information
- Communicating among students within the group (email)

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Area Name	Hits	Percentage
Group Pages	3709	15.61%
Group Discussion Board	16634	70.09%
File Exchange	502	2.11%
Email	159	0.66%

Figure 1. Functional Use of Blackboard Within the Groups

Figure 1 indicates that although all tools in the Group Pages area were used, the group discussion boards were by far the most popular. Data gathered from analyzing the postings made to the discussion boards evidenced that these were used in three ways. Early in the project, they were used to facilitate introductions among the group members. Once the introductions had been made, the individuals in the group used the discussion board for administrative purposes: organization of the project, distribution of tasks, posting of research and the creation of timelines. Finally, the discussion board was the site of the threaded discussions about the scenario itself. Postings made by the students were not anonymous so instructors could ascribe them to individuals thus enabling the measurement of individual contribution. Three out of the seven groups submitted their threaded discussions as part of the final report.

In the second year of the project eight multi-institutional groups, comprising 6 students each, were established and encouragement was again given, via the front-end notice-board facility, for them to begin by socializing with each other. Such initial socialization was encouraged because research (e.g. Jarvenpaa and Leidner, 1998) has identified that the building of trust is important to the development of virtual teams and that this can be achieved through social communication such as exchanging names, interests and other personal information.

However, in this second fieldwork study scaffolding of the learning experience was further achieved through initially requiring the students to focus on group work activity and to collaborate in production of a strategy for approaching the assignment itself. Such production of a group strategy then became an interim deliverable. All of the groups therefore started socializing by posting messages about themselves. Once such initial introductions had taken place they each debated their strategy until agreement was reached. Having posted their strategy by the deadline imposed, the groups then, as before, chose a scenario from the selection supplied by the course instructors and worked over the ensuing period of time using text-based asynchronous computer conferencing tools provided within the learning management system, Blackboard, to produce a report.

Again, in this fieldwork study, the intention was that instructor activity within the environment be that of monitoring and giving encouragement as this had previously proved to be effective for heightening participation by the students. However, the instructors in both the USA and Ireland were very reluctant to refrain from intervening in the group discussion areas, as they perceived moderation of the conferencing environment to be part of their role as a teacher. As a consequence, two of the instructors did make some postings to give advice on process. The effect of these instructor interventions then evidenced three different responses – a) student interaction proceeded to revolve around the instructor's comments, b)

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threads were terminated, c) no response within the discussion area was given. In one case one of the students actually challenged the intervention that the instructor had made commenting:

> "So, whilst I accept your comment, is it ethical to direct students away from considering the possible legal implications involved?"

The instructor responded to this comment by saying:

> "I didn't mean to direct just suggest".

This therefore evidenced the fact that at least one student's perception of instructor intervention was that he/she was being given direction that the student felt was inappropriate. In this case the student had the confidence to challenge it. Equally, it is quite likely that other students might have shared this view although they may not have had the courage to voice their opinion and actually challenge an instructor. The response of the student did, however, illustrate the influence the instructor was having upon the discussion and no further instructor postings were made directly into this particular group's area. However, upon assessment of the reports produced it was interesting to note that this particular group achieved one of the highest grades for its coursework, which was, as before, independently graded by each of the three instructors according to a mutually agreed grading scheme. After grading the reports independently, instructors shared their input and came to a consensus on the group report grade. Following this, an individual student's grade was adjusted where different levels of contribution were evidenced. Such adjustment was made, in particular, for two of the US students who failed to contribute fully to the discussion. For example, one student contributed only 4 messages in total and the other one just 9 to their particular group discussions. (This was in comparison with other students who posted between 20 and 40 messages each). It was also noted that the majority of the messages posted by these 2 individuals were simply agreements to what others had said rather than making any real contribution towards knowledge building in the group.

In regards to group activity within this fieldwork study, it was evident, from postings on the discussion board, that all of the groups progressed through the various phases of development identified by Tuckman, 1965 – forming, storming, norming, performing, adjourning. For example, in the "forming" stage (Tuckman, 1965) all of the groups began by having a high dependency on instructors in the F2F context for giving them guidance and direction as to how they were going to use the conferencing environment. Students were, therefore, dependent at this stage upon the instructors for setting them up into their groups within the virtual environment and had to have the various tasks outlined to them. This was achieved both verbally in the F2F contact sessions as well as through provision of both "hard" and "soft" copy written text. At this stage, three of the students exhibited some concern over using the conferencing environment, as this was a new experience for them while others were extremely enthusiastic about having the opportunity to communicate with students in other universities. For example there were some concerns expressed by one of the students regarding undertaking what they perceived to be "an experiment" in group work that would count towards their final degree classification (grade). In order to overcome such concerns the instructors had to be extremely supportive and encouraging to those students who were worried about the

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ensuing experience. Instructors thus had to make it very clear to students what their expectations of them were; for example, how such usage of the conferencing environment related to the learning outcomes for the module, how the students would be expected to use the discussion board, together with the safeguards that were in place to minimize any potential problems. Discussion of these and any other concerns raised were undertaken with the whole class in the F2F contact sessions. This could, of course, be aligned with one of the defining aspects of this phase identified by Tuckman (1965) - where students will test the tolerance of the leader/instructor. During the next stage, "storming", the necessity for vying for position was largely eliminated by virtue of the fact that the students had undertaken the Belbin (1981) Self-Perception Inventory. Students used the results to assign themselves roles and generally found this to be useful. For example, it made them much more aware of group dynamics in development of their strategy. Typical comments were:

> *"I think the group allocation of roles worked well"*
>
> *"I thought this strategy was grand. The delegation of work in the group worked well".*

However, there were, as Tuckman (1965) predicted, barriers to communication at this stage. For example one student commented:

> *"It was hard to get my ideas across through text instead of verbally and it is something I must work on."*

Nevertheless, requiring them to provide short biographies of themselves at the start of the project at least helped most of them overcome any initial reticence in making their first posting and one student commented:

> *"The threaded discussions proved an easy and valuable resource in combining everyone's ideas, arguments and suggestions".*

The next stage, "norming**",** evidenced that, in the main, individuals had accepted the various roles:

> *"As Company worker, I felt the role suited my practical, common sense and less creative aptitude towards solving problems."*

Apart from one or two students, general commitment to the group was perceived to be strong although some of this commitment was impacted by the workload that students carried. Thus, one or two students from each group withdrew from making any contributions to the discussion board during this phase. Three students, who felt the need to explain the reasons for such reduced contribution, later posted apologies for their lack of activity. At the "performing" stage the groups did evidence a clear focus in knowing why they were doing the exercise and what was expected of them. Each of the groups, therefore, exhibited a higher degree of autonomy during this stage and made, as expected, more rapid progress towards completion of the task as the deadline approached. Once again two of the groups exercised their own discretion in determining how late submissions should be handled. For example,

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where mitigating circumstances were offered, one group determined that the individual concerned should not be prevented from participating in the rest of the work whereas in the other group they decided that he/she should be excluded. The instructor then resolved this latter situation with the individual concerned. At the end of this stage all of the groups were successful in producing their report to deadline and the grades achieved were high.

Finally the majority of the groups (7 out of 8) engaged in the "adjourning" phase by posting messages indicating their pleasure at having worked with each other, wishing team members luck with their future and their exams, and generally thanking others for their efforts. Overall perception of the whole experience was positive with one student commenting:

> *"Being part of a group in a project of this kind opened my eyes in a way to the importance of communication among members in order for further development of the work".*

Thus, despite the fact that the groups never met F2F, there was clear evidence that group identity and cohesiveness had been developed plus clear indication that individuals were engaging in a great deal of reflection on their activity.

Survey

In the second year of the project, after the coursework reports had been submitted, the instructors distributed an electronic survey about the use of Blackboard in the International Collaboration in order to discover the strengths and weaknesses of the tool and the online collaboration from the participants' points of view. There were 22 respondents to the survey. Of those, 13 used Blackboard daily and 9 used it weekly. 14 students used it from 1-5 hours a week, and 5 used it between 5 and 10 hours a week. 2 students were on more than 10 hours/week and one was on less than an hour/week. The majority of students found that Blackboard was most useful when they wanted to initiate or contribute to an ongoing discussion (thread) and for observing the on-going discussions to find out what was happening in the group. Students found it less useful for personal research. The survey listed advantages of using Blackboard for an international collaboration: asynchronous nature of the tool, ease of access, identification of personal contribution, and asked students how important each advantage was in the project stages: initial setup of the project, the division of work and the production of the final report. A majority of the students surveyed felt that the online asynchronous nature of Blackboard was very important in all phases but especially in the division of work. They found the tool easy to access and this was especially important in the initial setup of the project. These respondents felt that the evidence of their own personal contribution to the paper was most important in the production of the final report.

The disadvantages stated in the survey were slow speed, data overload, security, quality assurance issues and not knowing the people and their skill levels. In the initial setup, the majority of surveyed students cited that not knowing the people and their skill levels was the most serious disadvantage. This appeared to be the most problematic in the division of work as well. Some groups overcame this obstacle by

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setting up an outline and allowing group members to pick their sections according to their strengths. Data overload seemed to be a problem in the final production as groups were scrambling to get their papers in final form.

Of the 20 students responding to whether Blackboard was useful for collaborative work, 15 said it was quite or very useful. The rest thought it had some use. We were curious as to what motivated students to contribute online. The majority liked the international dimension that afforded them the opportunity to get to know students in other institutions. Factors that discouraged contribution to the online discussion were mostly a lack of self-confidence in the student's ability to make his/her views known to peers. A majority of those surveyed felt that they had the same commitment to the online group as they would have had to a face-to-face group and would choose an online group again.

Conclusion

Although there were some problems, the instructors learned a lot from the initial study and refined and repeated it the next year. For example, the timeline of the project was adjusted to reflect the various holidays in the three countries. Because it seemed as if the commitment of the students to the project was linked to the percentage of his/her final course grade, the weighting of this project at the various institutions was adjusted in the second fieldwork study. Using a common rubric for assessment worked very well and the evaluations, which were independently done, correlated very nicely. There was overall agreement in all but one instance. As in any class with any group of students, our random sampling yielded students who worked harder than others. Some students were very focused on the goal of the collaboration while others were not. Some had excellent time management skills and helped keep their groups on track. In a group where time management was not a priority, there were poorer results. This would also be true in F2F groups. However, in this case, it was easy to ascertain the group difficulties and make suggestions because the instructors could participate on the group boards and monitor the discussions, i.e., they were present at what is analogous to group meetings. As a consequence, most problems could then be resolved either through email communication or within F2F contact sessions with the individual instructors at each of the universities. However, as in any classroom, some students took the advice; others did not.

Nevertheless, from the instructors' perspective it was felt that, overall, the on-line, international collaboration had successfully facilitated the production of very high quality reports. The collaboration had also meant that, as researchers, the instructors were able to refine and develop their approach towards educational research. For example, swapping ideas on various educational theories as well as determining the appropriate research methodology was particularly evident, as discussions for the second year's collaboration got under way. Such discussions did, of course, ultimately lead to the use of the Belbin (1981) Self Perception Inventory as a result of trying to find a more effective way of setting up balanced groups. Dissemination of findings through various publications has also meant that other practitioners have started thinking about using similar approaches to setting up international collaborations as a classroom exercise. Interest was particularly

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evident by instructors who sought to bring together students in culturally different contexts. On-line research did, therefore, prove to be both a feasible and highly rewarding experience for both the students and instructors involved.

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